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THE TREATMENT OF "OPPOSITION" IN FORMAL LOGIC

THOUGH a number of good text-books and elementary treatises on formal logic have recently appeared, the subject of the "opposition of propositions" is still usually put before students in a form very similar to that in which Aristotle left it. But that form is conspicuously deficient in clearness, precision, and systematic completeness. It is as if the syllogism were treated merely in a vague and general way, with no rules more detailed than the *dictum de omni,* no distinctions of mood and figure, no attempt at a complete enumeration of valid moods. In other words, the logical principles justifying the so-called "square of opposition" are, in no text-book known to me, definitely and lucidly worked out. The consequence is that college students commonly have difficulty in seeing the *why* of the relations with respect to joint truth or joint falsity that hold good between contraries, contradictories, and subcontraries; and many students, unable to reason through for themselves the logical necessities involved, merely stow away the "square" in their memories, upon the authority of book or lecturer—the one thing absolutely inexcusable in the study of formal logic. There is, however, a way (and, I think, only one way) of presenting the subject with system, precision, and complete self-evidence; and the logically adequate mode of presentation is also, experience leads me to believe, the pedagogically effective way, even with quite immature students. The matter is obvious enough, and the method in question is, no doubt, used by many teachers of logic; but it seems worth while to call attention to it in print, in the hope that it may come to be more generally used, both by teachers and by writers of text-books.

A. The Number of Possible Relations between the Denotations of Any Two Terms.—It is well known, and it is easy to demonstrate (though many text-books conceal the fact as if it were a dark secret), that there are five, and only five, conceivable relations of mutual inclusion or exclusion between two terms; and that any two terms whatever must, with respect to their areas of denotation, stand to each other in some one of these relations. In the concise phrasing of Venn: "Given one class as known and determined in respect of its extent, another class, also known and similarly determined, . . . can coincide with the former, can include it, be included by it, partially include and partially exclude it, or entirely exclude it. In every recognized sense of the word, these are distinct relations, and they seem to be the only such distinct relations which can possibly exist."[1] To formulate this more fully: if *S* and *P* be two terms whose denotation is *not* known, it is possible that they may hold to one another any one of the following relations, but it is not possible that they hold none of these relations:

1. All *S* may be all *P; i. e.,* the two areas of denotation may be coextensive.
2. All *S* may be merely some (and not all) *P*.
3. Some *S* may be all *P*.
4. Some *S* may be merely some *P*, while some of it is not *P*.
5. No *S* may be any *P*.

These relations would be graphically exhibited, in the usual manner, as follows: (1) By a diagram in which circle *S* and circle *P* are coextensive; (2) by a diagram in which circle *S* is within *P* and of less extension; (3) by a diagram in which circle *P* is within circle *S* and of less extension; (4) by overlapping circles, and (5) by mutually exclusive circles. It is to be observed that these formulas and diagrams express absolutely unequivocal situations—so far, at least, as is possible when the only quantitative distinction to be taken into account is that between whole and part; further, that with respect to the real relations of any two terms, the situations given are reciprocally exclusive as well as jointly exhaustive. In other words, the actual denotations of any two terms not only must be related in one of these ways, but also, they can not be, in fact, related in more than one.

B. The Import of the Four Types of Categorical Propositions with Respect to the Denotative Relations of their Terms.—The ordinary categorical propositions are, with one exception, notoriously incapable of expressing unequivocally the relations of their terms with respect to mutual inclusion or exclusion. What this means is that a given proposition known to be true does not enable us to know which *one* of the possible relations of the subject and predicate —in one of which, and one only, those terms really stand—is the actual relation. One who affirms such an equivocal proposition affirms merely that the two terms in question are related in one or another of two or more enumerable ways, and that the terms are not related in certain other ways (implicitly) excluded from that enumeration. Consequently, to make explicit in a perfectly clear and systematic manner the denotative import of each of the four types of categorical proposition, it is necessary to enumerate, in the case of each, all of the real situations compatible with the truth of the proposition. In other words, to understand what, in extension, the *A* proposition means, we must set down every relation between *S* and *P* which, if real, would justify the affirmation of *A*. Proceeding to this enumeration, we get the following result:

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[1] Venn, "Symbolic Logic," 1894, pp. 5 ff. Venn cites several earlier writers who have noted this fact and insisted upon its significance for the clear explication of the denotative import of ordinary propositions, and ascribes the earliest statement of it to Gergonne. Says Schröder ("Vorlesungen über die Algebra der Logik," 1891, Bd. II., 106): "These five relations were perceived by no one, from Aristotle's time down to the beginning of the nineteenth century (1816), when, so far as is known, they were first explicitly brought to light by Gergonne."

The *A* proposition is compatible with the reality of either relation (1) or (2); *i. e.*, one who affirms *A* declares that either relation (1) or else relation (2) is the actual fact; that, however, only one of these is actual; and that no other relation (of the five) beyond these two is actual. The *I* proposition is compatible with either (1) or (2) or (3) or (4); *i. e.*, whoever affirms it, declares that one or another of these relations is actual; that, however, only one of them is actual; and that no other relation is actual. With *E*, only relation (5) is compatible. With *O*, relations (3), (4) and (5) are compatible. In all the equivocal cases, it should be clearly understood, the relations enumerated as compatible with the given proposition are not jointly affirmed, nor is any one specifically affirmed. What the proposition most definitely affirms is the unreality of all the relations *not* enumerated under it; with respect to those enumerated, it virtually bids us hold our judgment in suspense. If students are to be taught to regard propositions as giving them any information at all about the comparative denotations of subject and predicate, they should be taught (as, in text-books, they usually are not) precisely and comprehensively what that information in each case is. In short, the foregoing seems to me the only sound way of presenting the doctrine of the denotative import of propositions.

C. Application of the Foregoing Principles to the "Opposition of Propositions."—In the light of the principles just set forth, it is possible to formulate rules of self-evident necessity, covering the possibility of joint truth or joint falsity of any two propositions having the same matter but differing in form. To frame these rules, it is needful only to glance at the lists of real relations compatible with the truth of each type of proposition—remembering that, so far as the proposition shows, *any* one of the relations enumerated under it is equally likely to be the one real relation; that no relation not enumerated under a given proposition admits of the truth of that proposition; and that, since any two terms must be related in one or another of the five ways, no pair of propositions can be jointly affirmed (or denied) if that would imply, for any two terms, the unreality, with respect to them, of *all* five denotative relations. The rules, then, are obviously as follows (letting the term "case" stand for "possible real relation of mutual inclusion or exclusion between the given subject and predicate"):

I. Where all the cases compatible with a given proposition are also compatible with another proposition (having the same matter), the truth of the latter may be inferred from the truth of the former.

II. Where only *some* of the cases compatible with a given proposition are also compatible with another proposition, from the truth of the former we can not infer that the latter is true, but as little can we infer that it is not true, *i. e.,* it remains doubtful.

III. Where two propositions are compatible with no common cases, from the truth of either the falsity of the other may be inferred.

IV. Where two propositions are compatible with no common cases, but between them exhaust all five possible cases, from the falsity of either the truth of the other may be inferred.

Examining the several propositions with these rules in mind, we see, for example, that Rule I. covers the relation of *A* to *I,* since both cases enumerated under *A* (1 and 2) are also enumerated under *I.* Hence, if *A* is true, *I* is true. Rule III. covers the relation of *A*'s truth to both *E* and *O,* since *A* has no cases in common with either of them; hence, if *A* is true, *E* and *O* are false. Rule IV. covers the relation of either *A* or *I* to *O,* since, if the cases compatible with either *A* or *I* be added to those compatible with *O,* all five conceivable cases will appear in the enumeration. Hence, neither *A* and *O,* nor *I* and *O,* can both be false; if one of either pair is false, the other must be true. In like manner, all the results set forth in the books under the name of "opposition" can be worked out.

This may at first seem longer and more complicated than the usual way of setting forth the subject. Even if it were so, it would be a preferable way; for it has, what the customary mode of exposition seems to me to lack, the merit of completeness of demonstration, and that sort of clarity for the understanding which comes only with the sense of having looked a problem through and through, from foundation to top, and of having noted everything pertinent that there was to note about it. And, in fact, the matter is, for teaching purposes, extremely simple to present. It requires only the drawing of five circle-diagrams; the assignment of a conventional number to each diagram; and then the setting down, opposite each type of proposition—*A, I, E* and *O*—of the list of cases compatible with it. The rest *saute aux yeux* of any fairly intelligent student. Indeed, the three topics here dealt with—under sections *A, B* and *C* —may best of all be given students in the form of problems to be worked out by themselves. There are, after all, great compensations in the fact that some important principles and interesting chapters of formal logic are left out of most of the books in current use as college texts. For the ideal teaching of logic would assuredly dispense with text-book expositions for all parts of the subject, and would invite students to repeat, and improve upon, the adventure of Aristotle—with only the aid (but the enormous aid) of clearly formulated statements of the next things to be looked for at each point —and, perhaps, for the duller wits, a little lifting over one or two *pontes asinorum.* No other object of study lends itself so perfectly to this pedagogical method.

Nothing that has been here said is meant to prejudice any of the ulterior questions of logical theory. Though I do, in fact, think it an error to maintain (as Mr. H. B. W. Joseph has most recently done) that "the predicate of a proposition is not thought in extension," I do not suppose that those who hold that view would deny that propositions may, for elementary pedagogical purposes, be treated as having a denotative import with reference to both their terms. At all events, in much current teaching, and in the most widely used manuals, they *are* so treated. And so long as this is done, it seems desirable that all the facts about their denotative import, and the immediate inferences which are justified by those facts, should be set forth in a logically cogent and a logically complete manner.

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REVIEWS AND ABSTRACTS OF LITERATURE

La définition de l'être et de la nature des idées dans le Sophiste de Platon. AUGUSTE DIÈS. Paris: Felix Alcan. 1909. Pp. a–c + vii + 140.

The scope of this admirably conducted inquiry is sufficiently indicated by the title. Like his countrymen, M. Piat and M. Brochard (*L'Année Philosophique,* 1907), M. Diès holds, as against the majority of German scholars, that the *Sophist* does not present a new view of reality, which sets it in opposition to the so-called "earlier" dialogues of Plato. He is, however, fully aware of the difficulties raised by the discussions of the *Sophist* and conscientiously sets them forth. It is clear that in this dialogue a certain shift is observable in the direction of Plato's interest, in that concrete reality is accorded a higher value than in his earlier thought. This observation led many scholars in former years—and there still remain a few of that persuasion—to regard the *Sophist* as an expression of the thought of Aristotle, since he too tended to think of the concrete as possessing the greater reality. But every student of Aristotle must soon become aware that the Stagirite was hopelessly divided, attaching supreme value now to the concrete, now to the abstract, and consequently failing to harmonize his system of thought. The same implicit contradiction is apparent in all the maturer works of Plato, the *Republic, Philebus,* and *Laws,* no less than the *Sophist.* In all these dialogues Plato